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Mr. Burkley has been a project manager in the Los Angeles Scientific Center since 1969. His current technical interests include the use of numerical geometry in all aspects of design, engineering and manufacturing, with particular emphasis on complex surface shapes. A related area of interest is in the use of distributed intelligence for graphic display and interaction with an end user. He joined IBM in 1964 and was a member of the group that produced the APT, AD-APT and AUTOSPOT processors for the IBM System/360. He has subsequently designed and implemented systems for direct numerical control of machine tools, adaptive control, and interactive NC programming. Mr. Burkley received a B.S. in physics from Georgetown University in 1961 and an M.S. in physics from Ohio State University in 1963. From 1959 to 1964 he worked as a physicist for the United States Navy, specializing in shock and vibration protection. He is a member of the Association for Computing Machinery, the Numerical Control Society and of Sigma Pi Sigma.

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Dr. Calhoun is manager of the bubble lattice development group. He joined IBM in 1956 in Poughkeepsie and moved to San Jose in 1971. He received a B.S. in 1947 from the University of Manitoba, an M.A. in 1948 from Wesleyan University, and a Ph.D. in 1953 from the Massachusetts Institute of Technology, all in physics. Dr. Calhoun is a fellow of the American Physical Society and a member of the American Association for the Advancement of Science, Sigma Xi, and the Magnetism Society of the Institute of Electrical and Electronics Engineers.

T. H. P. Chang

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Dr. Chang is manager of the electron beam fabrication systems group in the applied research department at the Thomas J. Watson Research Center, Yorktown Heights, New York, where he joined IBM in 1971. He was involved in electron beam technology while working for the Cambridge Scientific Instrument Company, England, from 1967-1971. Dr. Chang received his B.A., M.A., and Ph.D. degrees from Cambridge University.

Bernard Dimsdale

Data Processing Division, Los Angeles, California

Dr. Dimsdale is an industry consultant at the Los Angeles Scientific Center. He is currently working on applications of numerical geometry to problems in manufacturing, as well as to the field of biostereometry. He received a Ph.D. degree in mathematics in 1940 from the University of Minnesota, Minneapolis. Dr. Dimsdale joined IBM in 1956 as a member and later manager of the Los Angeles Data Processing Center. Other assignments included managing programming for the inventory management project now known as IMPACT. He is a member of the American Mathematical Society, the Mathematical Association of America, the Society for Industrial and Applied Mathematics, the American Association for the Advancement of Science, the Association for Computing Machinery, and Sigma Xi.

John S. Eggenberger

General Products Division, San Jose, California

Dr. Eggenberger is an advisory engineer in the exploratory storage technology department. He joined IBM in 1956 in Poughkeepsie, New York, where he worked in the areas of thin ferromagnetic films and ferrite core memories. His involvement in memory devices and systems has continued through assignments in the Research Division in Yorktown Heights, New York and San Jose, where he has worked since 1970. His current interest is in bubble devices and their application. Dr. Eggenberger received a B.S. degree in engineering physics from Lehigh University in 1956. In 1960, he was awarded an IBM Resident Scholarship to study toward the degree of M.S. in electrical engineering, which he received from Carnegie Institute of Technology in 1961. In 1962, he was awarded a second IBM Resident Scholarship, receiving a Ph.D. in electrical engineering from Stanford University in 1965. Dr. Eggenberger is a member of the Institute of Electrical and Electronic Engineers.

Michael Hatzakis

Research Division, Yorktown Heights, New York

Mr. Hatzakis joined IBM at the Thomas J. Watson Research Center, Yorktown Heights, New York in 1961. He worked in the electron beam group. He participated in the development of the electron beam recorder for the photostore project and the large scale integration program. He is presently working on the development of microfabrication techniques using electron beams, which includes development of electron sensitive resists and fabrication of submicron transistors and other devices. He received his B.S. in electrical engineering in 1964 and M.S. in electrical engineering in 1967 from New York University. Mr. Hatzakis is the author or co-author of over ten publications on electron beam resists and microfabrication techniques and has presented numerous papers on the subject. He is a member of Tau Beta Pi and Eta Kappa Nu.

John S. Heath

IBM United Kingdom, Hursley, England

Mr. Heath is manager of mechanical development in the storage development department at the Hursley laboratory. He received a diploma in technology from Woolwich Polytechnic Institute in 1959 and subsequently worked in various design and development positions in the U.K. Atomic Energy Authority and at Associated Electrical Industries Ltd. He joined IBM in Hursley in 1966, where his work assignments have been largely associated with head actuator design and development for low cost disk file products. In 1973 Mr. Heath was the recipient of the IBM Outstanding Contribution and the IBM Outstanding Invention Awards for his efforts in the development of the swinging arm actuator.

George E. Heidorn

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Dr. Heidorn is a research staff member in the automatic programming group of the computer sciences department at the Thomas J. Watson Research Center. His work for the past several years has been in the area of automatic programming through natural language dialogue, first for stimulation and now for business applications. For the four and one half years prior to joining IBM in 1973, he held the position of Assistant Professor of operations research and computer science at the U.S. Naval Postgraduate School in Monterey, California. Earlier, he had been a programmer/analyst at the New Departure Division of General Motors Corporation. He received a B.M.E. in 1962 from the General Motors Institute in Flint, Michigan, and received M. Phil. and Ph.D. degrees in operations research from Yale University in 1967 and 1972. Dr. Heidorn is a member of the Association for Computing Machinery, the Association for Computational Linguistics, and the Institute of Management Sciences.

Arthur Kern

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Mr. Kern is a staff member in the applied research department at the Thomas J. Watson Research Center. He received a B.A. from Brooklyn College in 1951. In 1958 while at RCA, he supervised and contributed to the design and implementation of the 501 System. In 1960 Mr. Kern supervised the design and implementation of a real time message switching system called ADX 7300 installed for ALCOA by ITT Corporation. He later joined IBM at the Thomas J. Watson Research Center and contributed to their virtual computer project, for which he received an IBM Outstanding Contribution Award. He is currently involved in the development of electron beam lithographic methods for large scale integration fabrication.

Hans E. Luhn

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Mr. Luhn is a technical associate in the electron beam fabrication group at the Thomas J. Watson Research Center. Since 1972 his primary responsibility has been the operation of the electron beam system and its associated work relating to electron beam lithography. In 1951 he graduated from the Carl Duisberg Schule in Wuppertal, West Germany, and joined IBM Research at the Watson Laboratory in New York City in 1956. He studied physics at Fairleigh Dickinson University, Teaneck, N.J. and Bridgeport University, Bridgeport, Connecticut.

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Research Division, San Jose, California

Dr. Heiman received his Ph.D. in physics from John Hopkins University in 1969. He remained there in a postdoctoral position for one year to continue his research in nuclear physics and Mossbauer spectroscopy. From 1970-1973, he held a postdoctoral position at the College of William and Mary, where he was involved in nuclear physics, nuclear magnetic resonance, Mossbauer spectroscopy and the application of muons to solid state problems. In 1973 he joined the inorganic materials department of the IBM Research Laboratory, San Jose.

Aare Onton

Research Division, San Jose, California

Dr. Onton is a member of the applied sciences department. His research has been in the area of luminescence, band structure, and impurity states of large band gap compounds and alloys. More recently he has been involved in the study of amorphous magnetic and ferroelectric materials. He received the B.S.E.E. and M.S.E.E. degrees from MIT in 1961 and 1962, and the Ph.D. in physics from Purdue University in 1967. He came to IBM at the Thomas J. Watson Research Center, Yorktown Heights, New York in 1967 as a Research Staff Member. During 1972-1973 he spent a year of sabbatical leave at the Max-Planck Institute, Stuttgart, Germany. He has been at the research laboratory in San Jose since 1973. He is a member of the American Physical Society.

William Parrish

Research Division, San Jose, California

Dr. Parrish is manager of the crystallography and microstructure department at San Jose, where he joined IBM in 1970. He is responsible for the characterization of materials using x-ray diffraction, transmission and electron microscopy, electron microprobe, x-ray fluorescence spectroscopy and energy dispersive methods for chemical analysis. His major research interest is in the development of x-ray and computer methods for profile fitting, a new powerful method of rapid precision data acquisition and reduction. He received the B.S. from the Pennsylvania State University in 1935 and the Ph.D. in mineralogy from Massachusetts Institute of Technology in 1940. He was a member of the faculty at Penn State from 1939-42, and was chief of the crystallography and x-ray sections at Philips Laboratories, Briarcliff Manor, New York, from 1943-68. He has been Chair-

man of the Commission on Crystallographic Apparatus of the International Union of Crystallography and Secretary of the U.S. National Committee for Crystallography and the Crystallographic Society of America. Dr. Parrish is the inventor of the diffractometer (the most widely used apparatus for the analysis of polycrystalline samples), is the author of books entitled *X-Ray Analysis Papers* and *Advances in X-Ray Diffractometry and Spectrography*, and the coeditor of *X-Ray and Electron Methods of Analysis*. In 1957 he prepared the First World Directory of Crystallographers.

Stanley R. Petrick

Research Division, Yorktown Heights, New York

Dr. Petrick is a member of the theoretical and computational linguistics group in the mathematical sciences department at the Thomas J. Watson Research Center, where he joined IBM in 1967. He received a B.S. degree in mathematics from Iowa State University in 1953, and in 1955, while on active duty in the U.S. Air Force, received an M.S. degree in electrical engineering from M.I.T. From 1955 to 1967 he was a member of the applied mathematics branch at the Air Force Cambridge Research Laboratories, first as an officer and later as a civilian. In 1965 he received a Ph.D. degree in linguistics from M.I.T. Following early work on switching circuits and speech recognition he has been primarily concerned with the syntactic analysis and semantic interpretation of natural languages. Dr. Petrick has been an Adjunct Associate Professor of computer sciences at the Pratt Institute since 1968. He is a member of the Linguistic Society of America, the International Linguistic Association, the Association for Computing Machinery, the Mathematical Association of America, Sigma Xi, and Phi Kappa Phi. He is currently President of the Association for Computational Linguistics.

Warren J. Plath

Research Division, Yorktown Heights, New York

Dr. Plath is manager of the theoretical and computational linguistics group at the Thomas J. Watson Research Center, where he joined IBM in 1964. His current research interests include the development of natural language understanding systems based on formally-defined subsets of English and the experimental use of such systems to provide non-programmers with a means of accessing information in formatted data bases. Following receipt of an A.B. degree in linguistics and mathematics from Harvard College in 1957, he spent a year as a Fulbright student in phonetics and communications research at the University of Bonn, Germany. In 1964, he received a Ph.D. degree in applied mathematics from Harvard University, where he taught graduate courses in computational linguistics in 1963-64. Dr. Plath is a member of the Association for Computational Linguistics, the Association for Computing Machinery, the International Linguistic Association, the Linguistic Society of America, and Sigma Xi.

Herbert P. Raabe

Potomac, Maryland

Dr. Raabe, a consulting engineer, has retired as a senior engineer in the ocean systems department of the Federal Systems Division in Gaithersburg, Maryland. He was responsible for the performance analysis of sonar sensors and arrays. He joined IBM in 1966 and became involved in the planning and management of an electronic counter-measures project and the design of a self-adapting phased array. From 1939 to 1945 Dr. Raabe was head of the Laboratory for Communications Techniques of the Technical University of Berlin, Germany. He also conducted research at the Heinrich-Hertz Institute for Oscillation Research and in 1945 developed a new microfilm viewing and storage system for the Society for Microfilm, Berlin. From 1946 to 1947 Dr. Raabe was associated with the Bureau of Communications Techniques, Berlin, where he developed a subsonic telemetering and control system and from 1947 to 1956 he was a technical consultant on airborne radar for the Aerial Reconnaissance Laboratory at the Wright-Patterson Airforce Base, Ohio. From 1956 to 1966 he was involved in radar systems analysis, electronic countermeasures effectiveness studies, propagation via artificial scatterers, passive communications satellites, and spacecraft attitude sensing and control in the Applied Science Division of Litton Industries. Dr. Raabe graduated from the Technical University of Berlin with a Dipl.-Ing. degree in 1936 and a Dr.-Ing. degree, summa cum laude, in 1939. He is a senior member of the Institute of Electrical and Electronics Engineers and a member of the American Institute of Aeronautics and Astronautics.

Laurence L. Rosier

Research Division, San Jose, California

Dr. Rosier is manager of the advanced storage technology group. He received a B.S. degree in 1959 and an M.S. degree in 1961, both in electrical engineering, from the University of New Mexico, Albuquerque. In 1961 he joined IBM in Poughkeepsie, where he worked on the development of semiconductor devices. In 1966 he received an IBM Resident Study Fellowship for graduate study at the University of Illinois, Urbana, and received a Ph.D. degree in physics in 1969. He joined the Thomas J. Watson Research Center in 1969, where he worked on magnetic bubble devices. In 1973 he transferred to the San Jose Research Laboratory. Dr. Rosier is a member of the American Physical Society and the Institute for Electrical and Electronic Engineers.

Lester F. Shew

General Products Division, San Jose, California

Mr. Shew is an advisory engineer in the General Products Division at San Jose, where he joined IBM in 1955. He is currently assigned to the advanced technology group. His work and contributions to the technical literature have been in the fields of magnetic recording, electrophotography, holography and magnetic devices. Mr. Shew received the B.S.E.E. degree from Oregon State University in 1937 and the M.E.E. degree from Rensselaer Polytechnic Institute in 1938. He is a senior member of the Institute of Electrical and Electronics Engineers and a member of Sigma Xi.

John F. Sowa

System Communication Division, Mohansic, New York

Mr. Sowa is an advisory engineer in an advanced systems programming development group. He joined IBM in 1962 after receiving a B.S. in mathematics from MIT. In 1966, under the IBM Resident Graduate Study Program he earned the M.A. in applied mathematics at Harvard University. While at IBM, he has worked on various aspects of computer architecture, performance evaluation and programming language design and implementation. His main technical interests are in artificial intelligence and computational linguistics; he has taught several courses at IBM on these subjects and is now writing a book entitled *Conceptual Structures: Information Processing in Mind and Machine*. Mr. Sowa is a member of the Association for Computing Machinery and the Association for Computational Linguistics.

Albert J. Speth

Research Division, Yorktown Heights, New York

Mr. Speth is a staff member in the applied research department at the Thomas J. Watson Research Center, where he joined IBM in 1962. He received a B.E.E. from Manhattan College in 1956 and an M.E.E. from Syracuse University in 1958. Prior to joining IBM, he was on the research staff at New York University. His work at IBM has been principally the development of components and systems in the electron beam recording and microfabrication area. He is a member of Eta Kappa Nu and the Institute of Electrical and Electronics Engineers.

James C. Suits

Research Division, San Jose, California

Dr. Suits is currently involved in a study of the crystallographic and magnetic properties of novel amorphous and crystalline materials. He joined the IBM Research Division in 1960 at Yorktown Heights and has worked in San Jose since 1967. He received a B.S. in physics from Yale University in 1954, attended Cornell University from 1954 to 1957, and received a Ph.D. in applied physics from Harvard University in 1960. Dr. Suits is a fellow of the American Physical Society and a member of the Institute of Electrical and Electronics Engineers.

Alan D. Wilson

Research Division, Yorktown Heights, New York

Mr. Wilson is a staff member in the applied research department at the Thomas J. Watson Research Center, involved in the development of electron beam microfabrication technology. He joined IBM in Endicott N.Y. in 1960 where he was engaged in the development of photo-sensing devices, display techniques and light sources. He made a number of original contributions in the areas of incandescent tungsten and filament device failure. While involved in a research project, he developed some basic fringe formation rules and analysis methods for holography of vibrating objects, particularly multifrequency conditions. He has contributed papers and presentations to the field of holographic interferometry, both here and abroad, and has received several patents in the area of electro-optical devices, holography and energy sources. Mr. Wilson received a B.S.E.E. degree from the University of Utah in 1959 and an M.S.E.E. from Cornell University in 1960. He is a member of the American Optical Society, Eta Kappa Nu and Tau Beta Pi.

Contents of previous issues

January 1976

Vol. 20, No. 1

• Papers

Computers and the Space Program:
An Overview

C. C. Kraft, Jr. 3

Development of On-board Space Computer
Systems

A. E. Cooper and W. T. Chow 5

Redundancy Management Technique for
Space Shuttle Computers

J. R. Sklaroff 20

Performance Modeling of Earth Resources
Remote Sensors

R. H. Kidd and R. H. Wolfe 29

Digital Image Processing of Earth
Observation Sensor Data

R. Bernstein 40

Skylab Attitude Control System

T. R. Coon and J. E. Irby 58

Large Space Telescope

F. J. Hudson 67

Launch Processing System

*F. Byrne, G. V. Doolittle and
R. W. Hockenberger* 75

• Communication

Real-Time Orbiter Abort Guidance

V. S. Sohoni 84

Submicrometer Stripes and Bubbles in Amorphous Films <i>P. Chaudhari and S. R. Herd</i>	102	Drop Formation from a Liquid Jet: A Linear One-dimensional Analysis Considered as a Boundary Value Problem <i>W. T. Pimbley</i>	148
Bubble Lattice Motions Due to Modulated Bias Fields <i>B. E. Argyle, J. C. Slonczewski and O. Voegeli</i>	109	Objects and Values: The Basis of a Storage Model for Procedural Languages <i>D. B. Lomet</i>	157
Storage Management Operations in Linked Uniform Shift-Register Loops <i>T. C. Chen and C. Tung</i>	123	Error Correcting Codes for Satellite Communication Channels <i>C. L. Chen and R. A. Rutledge</i>	168
Effects of Abrupt Changes in Film Thickness on Magnetic Bubble Forces <i>T. W. Collins and R. W. Cole</i>	132	Electric Motor Requirements for Positioning an Inertial Load <i>J. H. Meier and J. W. Raider</i>	176
Bases for Chain-complete Posets <i>G. Markowsky and B. K. Rosen</i>	138		

• *Papers*Generalized Kraft Inequality and
Arithmetic Coding*J. J. Rissanen* 198Analysis of the Berlekamp-Massey Linear
Feedback Shift-Register Synthesis Algorithm*F. G. Gustavson* 204Deep-UV Conformable-Contact Photolithography
for Bubble Circuits*B. J. Lin* 213Lattice Dynamics with Three-Body Forces:
Solid Xe and Kr*J. A. Barker, M. L. Klein and M. V. Bobetic* 222

LSI Yield Modeling and Process Monitoring

C. H. Stapper 228Delayed Closed-Loop Scheme for Stepping
Motor Control*B. Bechtle, C. Schünemann, G. Skudelny and
V. Zimmermann* 235Optimization of Single Expressions in a
Relational Data Base System*P. A. V. Hall* 244Dependence of Ink Jet Dynamics on Fluid
Characteristics*C. A. Bruce* 258Amorphous Materials for Micrometer and
Submicrometer Bubble Domain Technology*C. H. Bajorek and R. J. Kobliska* 271• *Communications*Complex Convolutions via Fermat Number
Transforms*H. J. Nussbaumer* 282Speckle Pattern Interferometry of Vibration
Modes*I. M. Andrews and J. A. Leendertz* 285• *Letter to the Editor*Comment on "Segment Synthesis in Logical
Data Base Design"*G. Wiederhold* 290